GLOBAL CHANGE AND COASTAL SYSTEMS:
PATTERNS POSSIBLY AFFECTING FREQUENCY OF DROUGHT

Virginia Burkett
Chief, Forest Ecology Branch, National Wetlands Research Center
U.S. Geological Survey, 700 Cajundome Blvd.
Lafayette, Louisiana 70506 (phone 337-266-8636; fax 337-266-8592;
virginia_burkett@usgs.gov)

During the 20th century, average temperature increased by approximately 1°F, and precipitation increased by 5 to 10% across most of the United States, mostly in the form of heavy rainfall (rainfall > 2 inches/day). In the Southeast, temperature increases since 1950 have been modest compared with that of other regions, but annual rainfall trends show very strong increases of 20-30% or more over the past 100 years across Mississippi, Arkansas, South Carolina, Tennessee, Alabama, and parts of Louisiana. The timing of rainfall has also changed over the past century, and models suggest that future trends in temperature and rainfall could affect the frequency of both drought and flood events in areas such as the Mississippi River floodplain and the northern Gulf of Mexico coastal zone.

Climate simulation models (GCM's) used in the U.S. National Assessment suggest that average temperatures in the Southeast could rise by 2-3°F by 2030 and by 4-10°F by 2100. The GCM's predict more precipitation in the form of rainfall, more rainfall in the form of heavy downpours, and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. Sea surface temperature in the equatorial Pacific is predicted to resemble a more steady-state, El Niño-like condition by 2100, which suggests that fewer hurricanes will make landfall in the gulf coast, but that rainfall associated with both hurricanes and La Niña events will be more intense. In addition, sea-level rise is predicted to accelerate due to global warming 2- to 5-fold over the next century. Sea-level rise will likely continue to have serious impacts on low-lying coastal marshes, particularly in Louisiana where Holocene deltaic sediments are dewatering and compacting due to natural processes and man's development activities.

Changes in precipitation extremes (both droughts and floods) caused by increased temperature and humidity will likely have major effects on the structure and function of coastal ecosystems. Seasonal patterns indicate that projected changes will be greatest in the winter months, but large increases in summer temperature are projected by most GCM's for most of the Gulf Coastal Plain. Changes in growing season length, photosynthesis, and evapotranspiration rates will affect the potential range of many plant species, as well as competition among species. Mild southeastern winters since 1970 have already enhanced species such as the invasive, freeze-intolerant Chinese tallow tree, at the expense of native hardwoods.

Although there is uncertainty inherent in any predictive modeling effort, the models and historical trends presented in the National Assessment provide a plausible set of climatic and ecological scenarios for the 21st century. The implications of the changes in climate

that are simulated by most climate models present serious issues for those responsible for the conservation of coastal resources. One of five key findings of the National Assessment is that "natural ecosystems appear to be the most vulnerable to the harmful effects of climate change." The rate of ecological change that is likely to occur will not allow for the gradual migration or genetic adaptation of many species, particularly when coupled with habitat fragmentation, invasive species, and other consequences of development activities by humans. However, some practical and potentially effective strategies to minimize impacts to coastal ecosystems have emerged. Insights about climate change and its likely impacts should be core tools for coastal resource managers who are engaged in activities such as land acquisition, water resources negotiations, habitat restoration, invasive species control, fisheries and waterfowl management, and, in general, planning for the future.